US010828079B2

(12) **United States Patent**
Vikinsky et al.

(10) **Patent No.: US 10,828,079 B2**
(45) **Date of Patent: Nov. 10, 2020**

(54) **K-WIRE ADAPTOR ASSEMBLY**

(71) Applicant: **PREMIA SPINE LTD.**, Ramat Poleg (IL)

(72) Inventors: **Ofer Vikinsky**, Zur-Igal (IL); **Ron Sacher**, Herzelia (IL)

(73) Assignee: **Premia Spine Ltd.**, Ramat Poleg (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 310 days.

(21) Appl. No.: **15/564,006**

(22) PCT Filed: **Apr. 12, 2016**

(86) PCT No.: **PCT/IB2016/052074**
§ 371 (c)(1),
(2) Date: **Oct. 3, 2017**

(87) PCT Pub. No.: **WO2016/166662**
PCT Pub. Date: **Oct. 20, 2016**

(65) **Prior Publication Data**

US 2018/0132920 A1 May 17, 2018

Related U.S. Application Data

(60) Provisional application No. 62/146,318, filed on Apr. 12, 2015.

(51) **Int. Cl.**
A61B 17/58 (2006.01)
A61B 17/88 (2006.01)
A61B 17/70 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 17/8897*** (2013.01); ***A61B 17/7082*** (2013.01); ***A61B 17/888*** (2013.01); ***A61B 17/8875*** (2013.01); *A61B 17/8872* (2013.01)

(58) **Field of Classification Search**
CPC A61B 17/8897; A61B 17/7082; A61B 17/888; A61B 17/8872; A61B 2017/90
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,326,203 B2 * 2/2008 Papineau A61B 17/32002 606/104
2006/0248988 A1 * 11/2006 Bennett A61B 17/1624 81/62

(Continued)

OTHER PUBLICATIONS

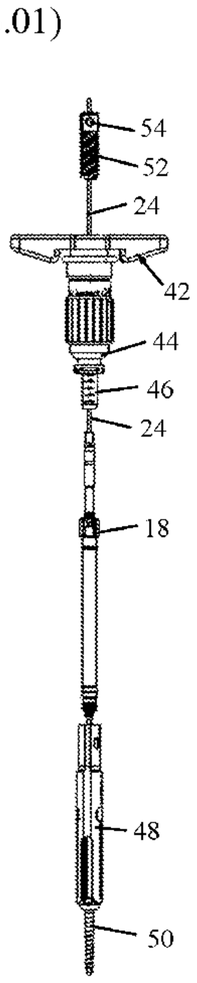
PCT Search Report and Written Opinion PCT/IB2016/052074, dated Aug. 25, 2016.

Primary Examiner — Jessica Weiss
(74) *Attorney, Agent, or Firm* — Dekel Pant Ltd.; David Klein

(57) **ABSTRACT**

A surgical tool adaptor includes a distal interface member and a handle. The distal interface member includes a connecting element for connecting to a surgical tool. A K-wire connector is disposed in a central passageway for receiving therethrough a K-wire. The K-wire connector includes a locking element for locking the K-wire. A clutch mechanism is operatively connected to the distal interface member and to the K-wire connector, wherein in a first orientation of the clutch mechanism, the distal interface member and the K-wire connector move together, and in a second orientation of the clutch mechanism, the distal interface member is declutched from the K-wire connector, so that in the first orientation movement of the handle moves the distal interface member and the K-wire connector together, and in the second orientation the distal interface member and the K-wire connector move independently of each other.

12 Claims, 5 Drawing Sheets



(58) **Field of Classification Search**
USPC 606/103–104, 96–98
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2009/0228013	A1	9/2009	Bourque	
2009/0254094	A1*	10/2009	Knapp	A61B 17/1637 606/96
2012/0004665	A1	1/2012	Defossez	
2014/0276892	A1*	9/2014	Pakzaban	A61B 17/8875 606/104
2014/0276894	A1*	9/2014	Ramsay	A61B 17/7076 606/104

* cited by examiner

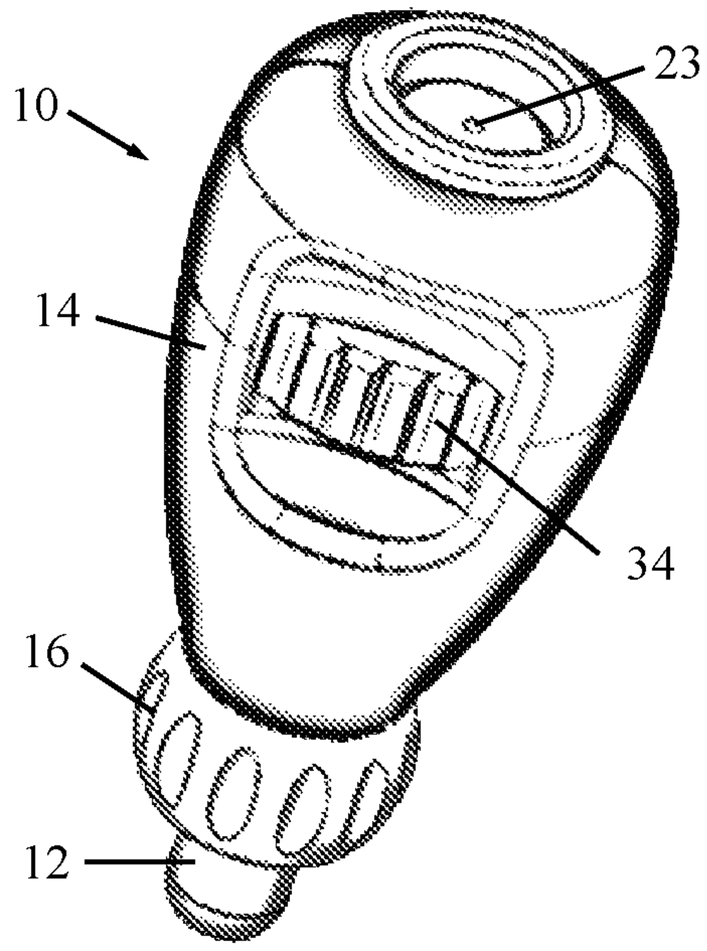


FIG. 1A

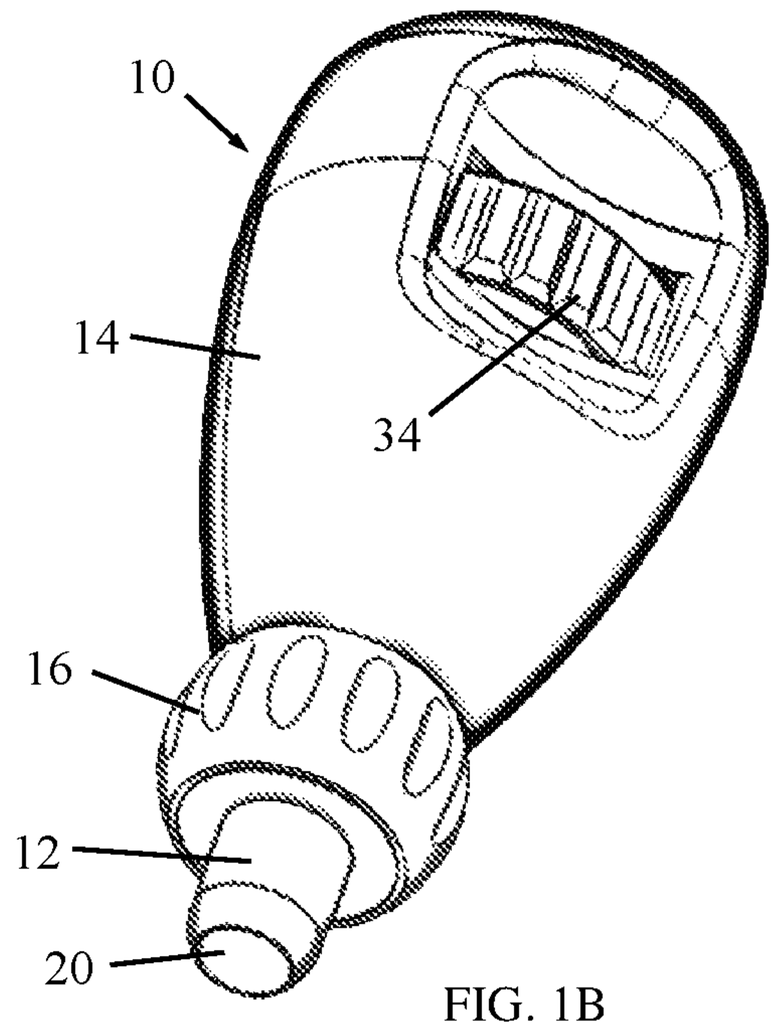


FIG. 1B

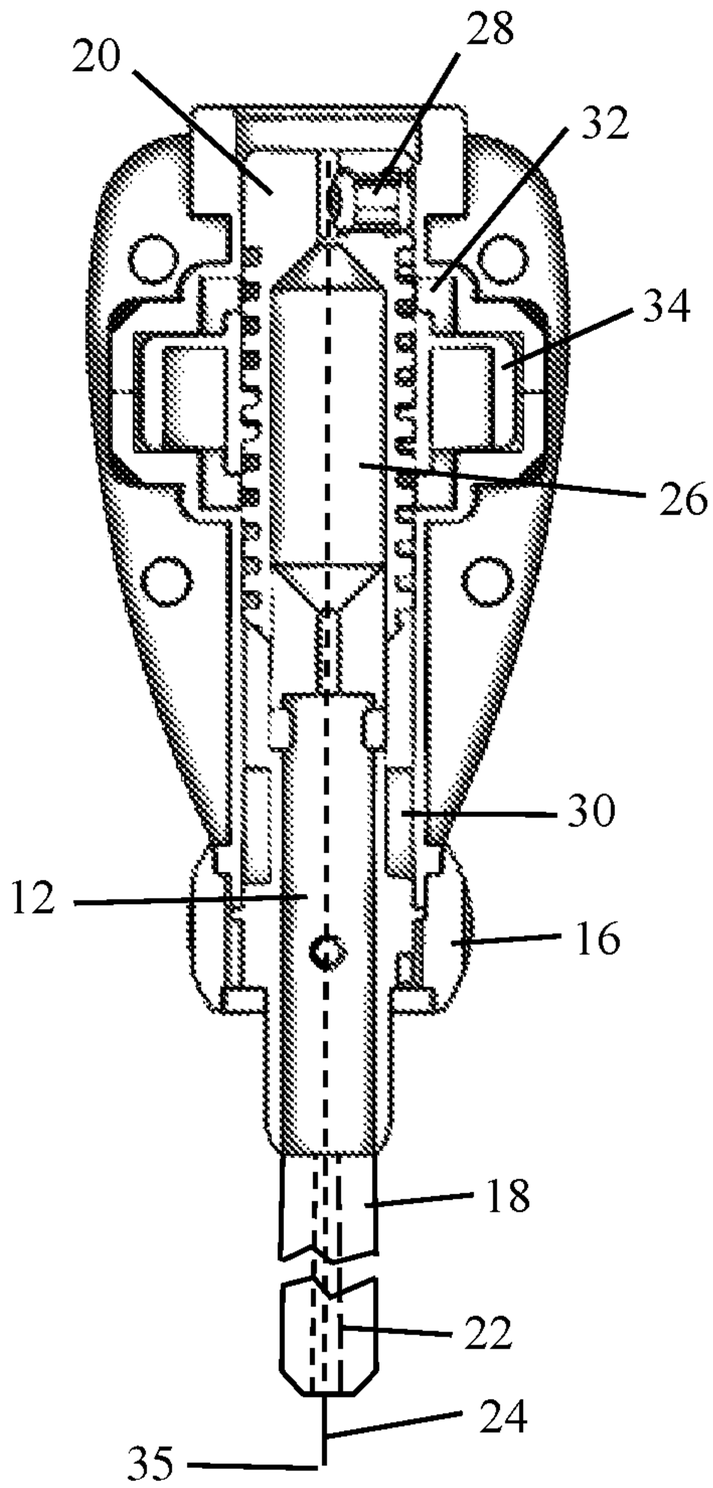


FIG. 2

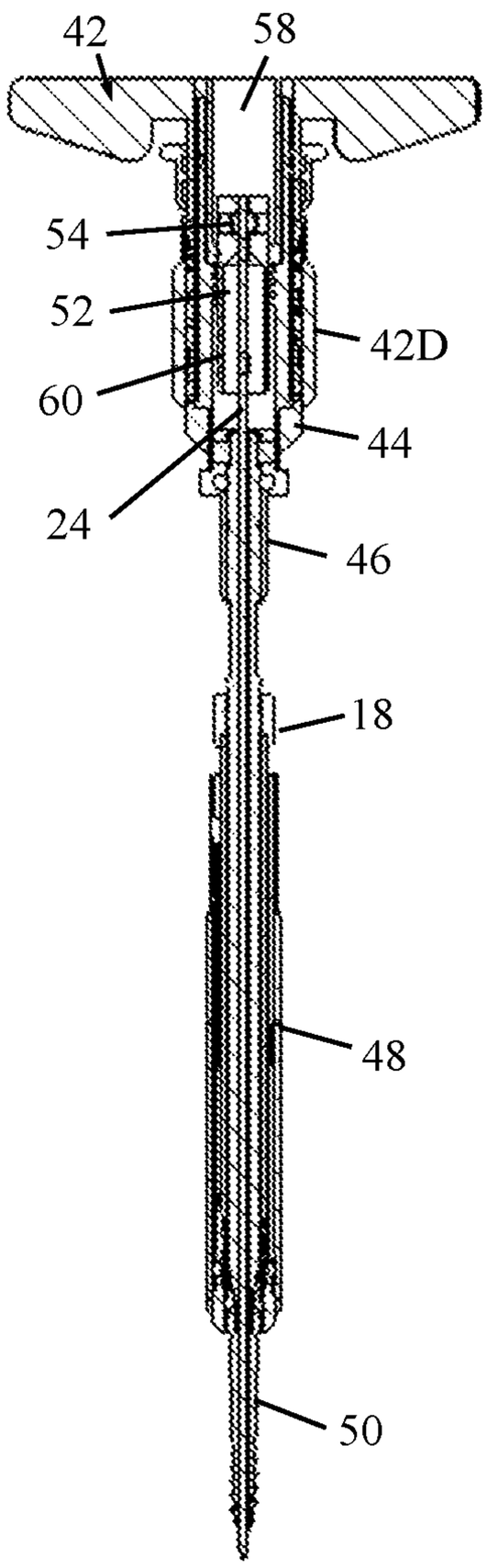


FIG. 3A

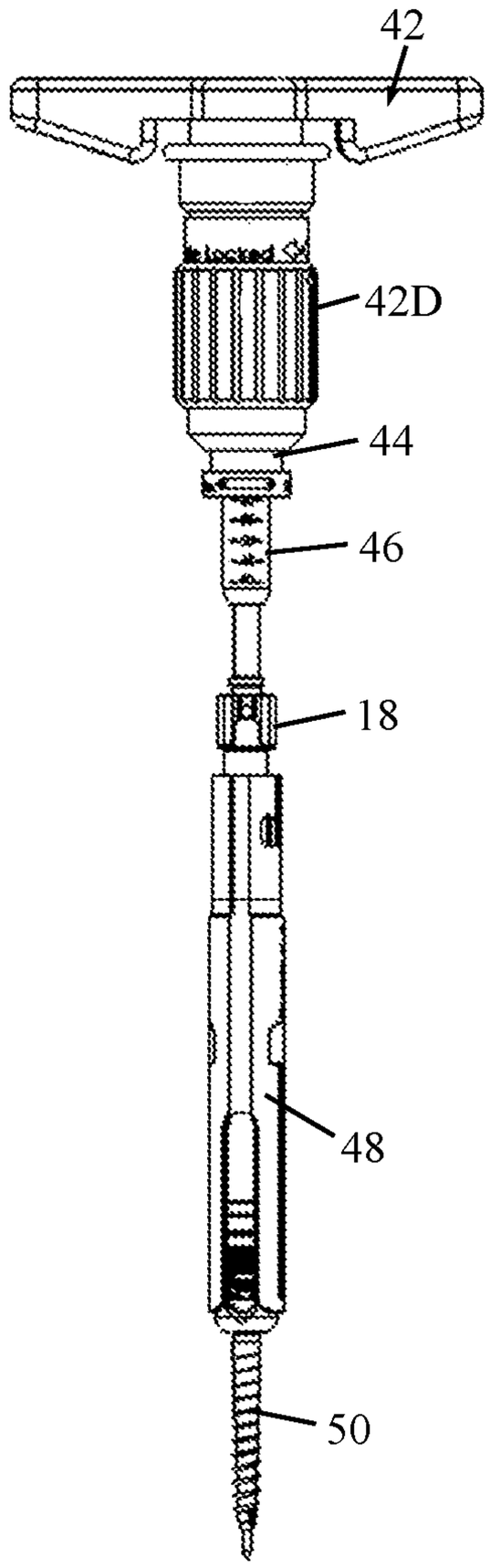


FIG. 3B

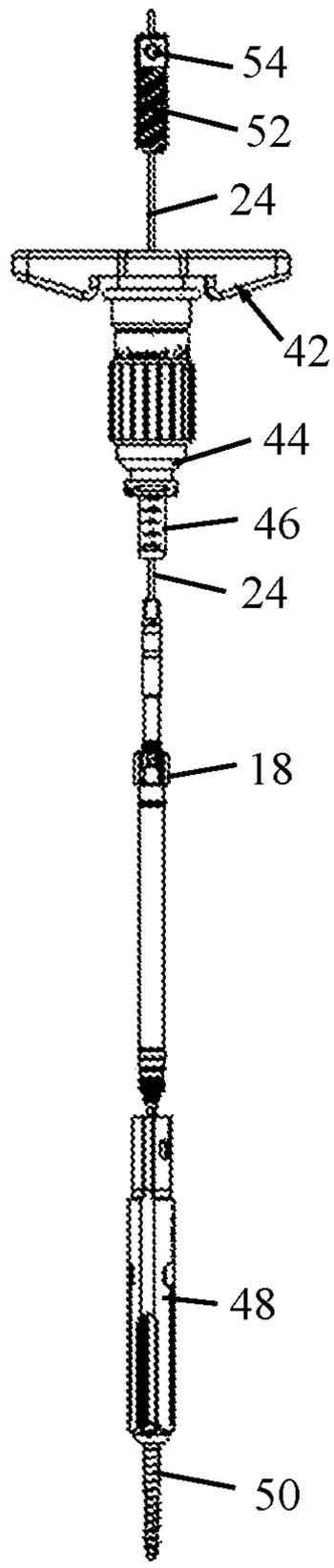


FIG. 3C

FIG. 3D

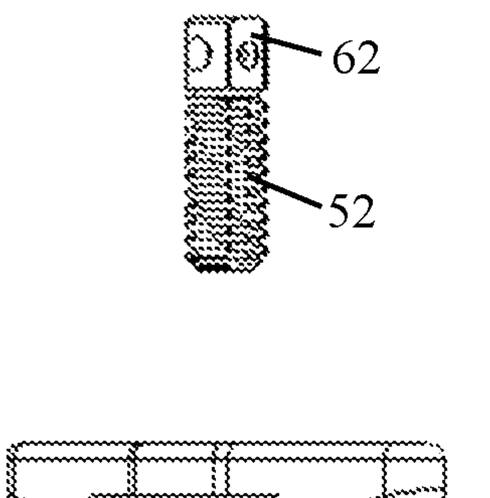


FIG. 3E

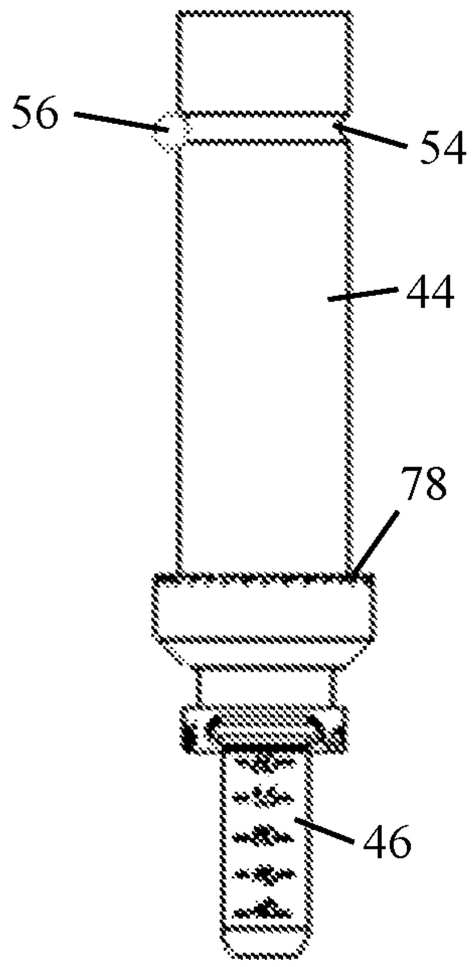


FIG. 3F

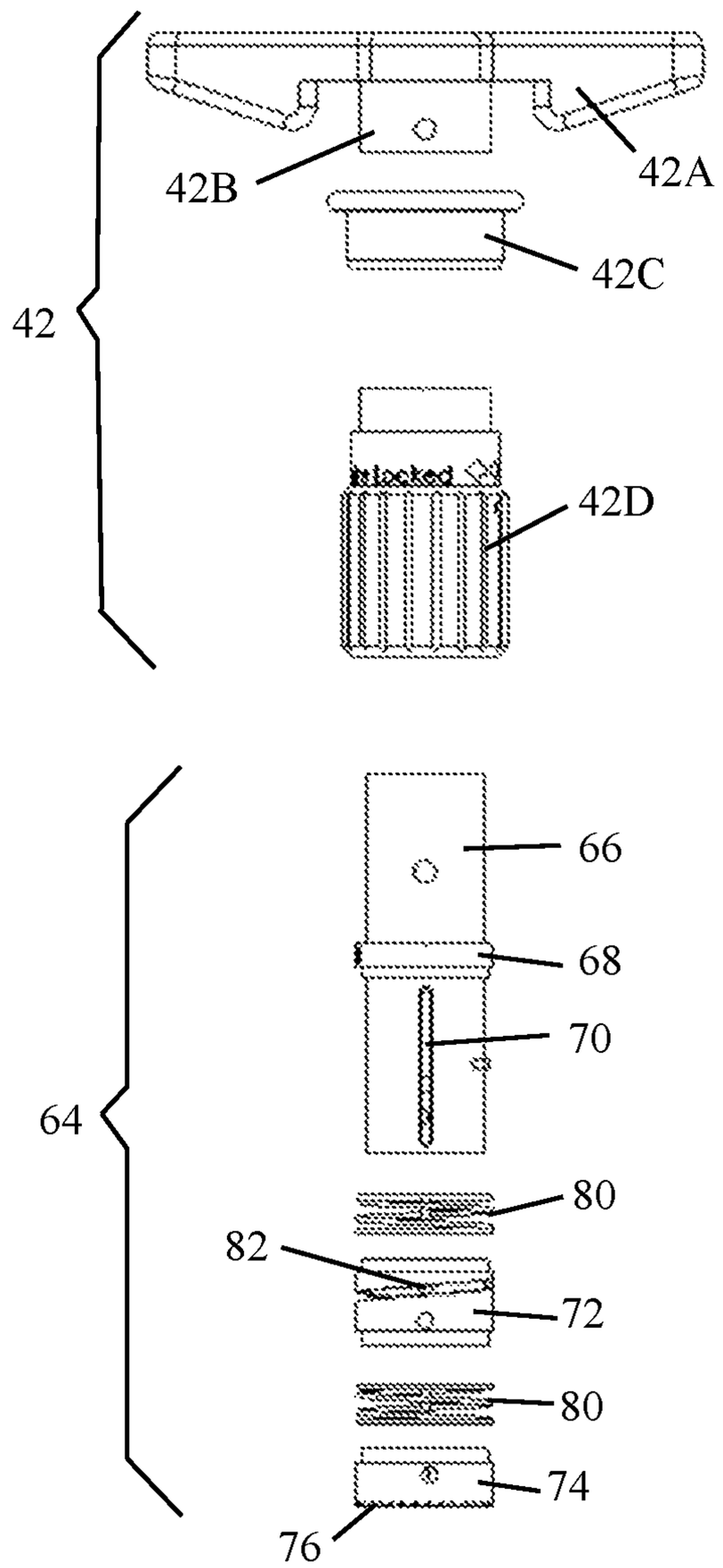


FIG. 3G

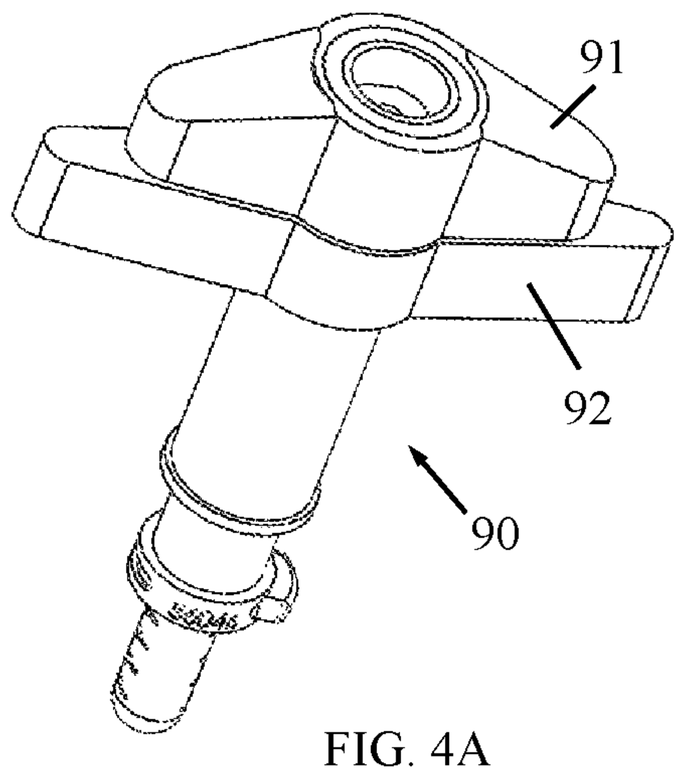


FIG. 4A

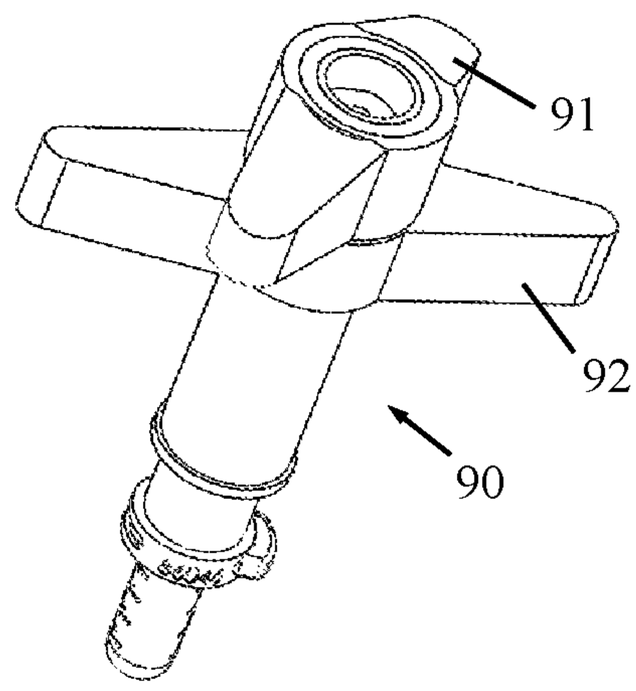


FIG. 4B

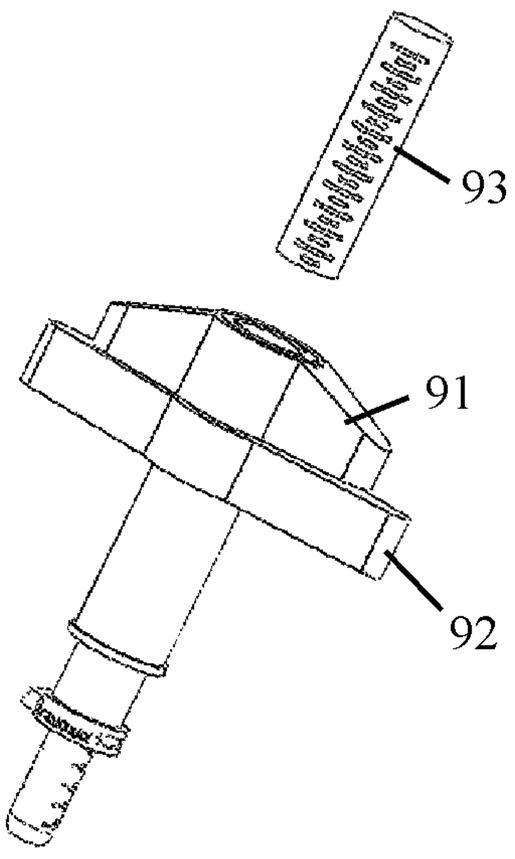


FIG. 4C

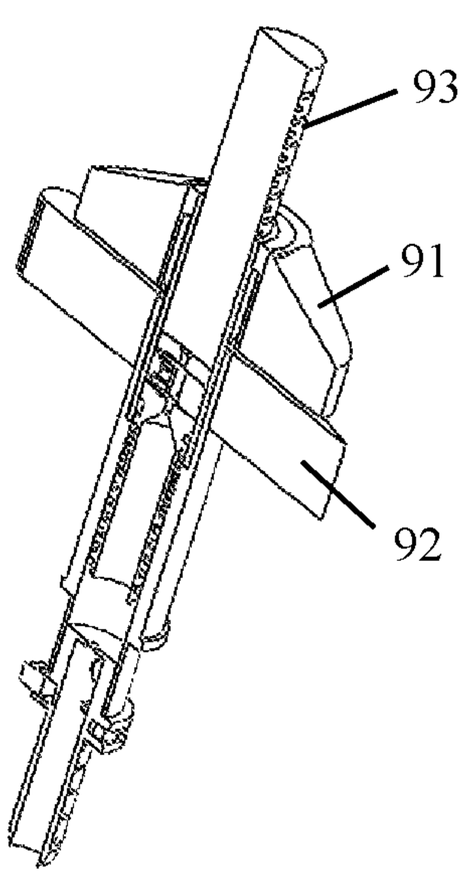


FIG. 4D

K-WIRE ADAPTOR ASSEMBLY

FIELD OF THE INVENTION

The present invention relates generally to methods and apparatus for controlled placement of surgical devices over a Kirschner wire (K-wire), such as but not limited to, screwdrivers, taps, bores, awls, probes, jamshidi needles, and others.

BACKGROUND OF THE INVENTION

Medical procedures involving the vertebrae are normally complicated because of the preciseness and accuracy required to avoid both neural damage and injury to major blood vessels. For example, some medical procedure require placing an anchor of some sort (e.g., screw) into a specific place in the vertebrae. Misalignment or other incorrect placement of the screw can result in injury or failure in the connection between the bone and hardware. These surgeries sometimes require penetration of the hard cortical bone of the vertebra and traversal of the softer cancellous bone lying thereunder. A large force is normally required by the surgeon to penetrate the cortical bone. Once the cortical bone is penetrated, extreme care must then be taken to avoid rapidly penetrating through all of the cancellous bone. There is also the danger of rapidly passing through the cancellous bone and then through the cortical bone on the other side of the vertebra. This can result in injury or damage to the spinal cord and/or other organs or blood vessels located adjacent the spine.

For example, in certain surgical procedures, a K-wire or similar guide wire (the terms being used interchangeably throughout) is used in combination with a cannulated surgical tool, such as a screwdriver, tap, bore, awl, probe, or jamshidi needle, to name some. The K-wire is positioned through the pedicle and into the vertebral body to indicate or establish the position of subsequent screw placement. Once the proper positioning of the K-wire is confirmed by X-rays, the screw connected to the screwdriver is guided over the K-wire through the lumen (cannula) of the surgical tool and penetrates into the bone, which if not done properly can injure the patient, particularly if the K-wire encounters certain sensitive tissues. The procedures often require the use of force which can cause an otherwise properly positioned K-wire to move forward into the surgical site, which if excessive can move into contact where contact is to be avoided.

Thus, controlling the position of the K-wire sharp tip is critical for the patient safety. In a normal screw placement over a K-wire, the K-wire is placed to the desired depth, and then the screw is advanced over the K-wire. The surgeon must make sure the tip of the K-wire is not pushed further distally towards the anterior cortex of the vertebral body. If the K-wire tip were to puncture through the vertebra it could damage major blood vessels and cause major bleeding.

SUMMARY OF THE INVENTION

The present invention seeks to provide an improved device for controlled placement of surgical devices over a K-wire, as described more in detail hereinbelow.

The term K-wire throughout the specification and claims encompasses any slender, elongated piece with a tip used for entering bone, such as a K-wire or Steinmann pin.

In brief, the device enables inserting a K-wire through a lumen of a cannulated surgical tool. In the case of a screwdriver, for example, the K-wire also passes through the lumen of the screw. The device is easily used to position the K-wire so it protrudes a little bit (e.g., a few mm) beyond the distal tip of the screw or surgical tool. The device is then used to lock the K-wire with respect to the screw or tool. The device is adjustable so that its proximal end can be flush with the proximal end of the K-wire, so that the surgeon can hammer or otherwise apply force on the proximal end of the device in order to advance the K-wire and screw or tool together. The K-wire breaches the cortical bone (or other spinal structure which the surgeon wishes to breach) and brings the tip of the cannulated screw or tool to the bone surface. From there, the surgeon can screw in the pedicle screw or advance the tool without concern for slipping. Without the device, the screw or tool can slip at the point of entry. The tip of the k-wire also ensures that the entry point is not lost during screw angulation, and facilitates finding or changing entry points The invention saves time and effort to insert screw or other surgical tools.

There is thus provided in accordance with an embodiment of the present invention an assembly including a surgical tool adaptor including a distal interface member and a handle, the distal interface member including a connecting element for connecting to a surgical tool, a central passageway being formed through the distal interface member and the handle, a K-wire connector disposed in the central passageway for receiving therethrough a K-wire, the K-wire connector including a locking element for locking the K-wire, and a clutch mechanism operatively connected to the distal interface member and to the K-wire connector, wherein in a first orientation of the clutch mechanism, the distal interface member and the K-wire connector move together, and in a second orientation of the clutch mechanism, the distal interface member is declutched from the K-wire connector, so that in the first orientation movement of the handle moves the distal interface member and the K-wire connector together, and in the second orientation the distal interface member and the K-wire connector move independently of each other.

In accordance with an embodiment of the present invention, in the second orientation, a first movement of the handle moves the K-wire connector while the distal interface member remains stationary.

In accordance with an embodiment of the present invention, in the second orientation, a second movement of the handle moves the distal interface member while the K-wire connector remains stationary.

In accordance with an embodiment of the present invention, in the second orientation, a third movement of the handle moves the distal interface member in one direction and moves the K-wire connector in a different direction.

In accordance with an embodiment of the present invention the clutch mechanism is movably connected to the handle.

In accordance with an embodiment of the present invention (FIGS. **1**A, **1**B and **2**) the clutch mechanism includes a first ratchet mechanism operatively connected between the distal interface member and the handle, which in a first direction causes the distal interface member and the handle to move together and in a second direction declutches the distal interface member from the K-wire connector, so that in the first direction movement of the handle moves the distal interface member and the K-wire connector together, and in the second direction movement of the handle moves the distal interface member without moving the K-wire connector. The assembly may further include an adjustment

knob operative to move the K-wire connector independently of the first ratchet mechanism.

The assembly may further include a second ratchet mechanism operatively connected between the adjustment knob and the handle, which in the first direction declutches the K-wire connector with respect to the adjustment knob, and in the second direction causes the adjustment knob and the K-wire connector to move together, so that in the second direction movement of the handle moves the adjustment knob and the K-wire connector together.

In accordance with another embodiment of the present invention (FIGS. **3**A-**3**G) the clutch mechanism includes a ratchet assembly that includes a mode transition element and a ratchet member formed with ratchet teeth arranged to engage teeth formed on the distal interface member, and wherein the handle engages the mode transition element, so that turning the handle causes axial movement of the mode transition element.

In accordance with an embodiment of the present invention (FIGS. **4**A-**4**D) the clutch mechanism includes an auxiliary handle connected to the distal interface member, and wherein the first-mentioned handle is connected to the K-wire connector and the first-mentioned handle and the auxiliary handle are coaxial.

In accordance with an embodiment of the present invention a K-wire is disposed through the central passageway and locked to the K-wire connector.

In accordance with an embodiment of the present invention a surgical tool is connected to the connecting element. The surgical tool may include a screw, a screwdriver, a tap, a bore, an awl, a probe, or a jamshidi needle.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

FIGS. **1**A and **1**B are simplified perspective views of a surgical tool adaptor, constructed and operative in accordance with an embodiment of the present invention;

FIG. **2** is a simplified cutaway-view illustration of the surgical tool adaptor;

FIG. **3**A is a simplified sectional illustration of a surgical tool adaptor, constructed and operative in accordance with another non-limiting embodiment of the present invention;

FIG. **3**B is a simplified pictorial illustration of the surgical tool adaptor of FIG. **3**A;

FIG. **3**C is a simplified pictorial illustration of the surgical tool adaptor, with some of the parts separated so as to show a K-wire that passes through a K-wire adaptor screw;

FIGS. **3**D and **3**E are simplified pictorial illustrations of a handle of the surgical tool adaptor of FIG. **3**A mounted and dismounted from a distal interface member, respectively;

FIG. **3**F is a simplified pictorial illustration of the distal interface member;

FIG. **3**G is a simplified exploded illustration of the handle and the ratchet assembly of the surgical tool adaptor of FIG. **3**A;

FIGS. **4**A and **4**B are simplified pictorial illustrations of a surgical tool adaptor, constructed and operative in accordance with another non-limiting embodiment of the present invention, with two handles at different rotational orientations with respect to each other; and

FIGS. **4**C and **4**D are simplified pictorial and cutaway illustrations, respectively, of the surgical tool adaptor of FIG. **4**A with an additional scale insert mounted in the adaptor.

DETAILED DESCRIPTION OF EMBODIMENTS

Reference is now made to FIGS. **1**A, **1**B and **2**, which illustrate a surgical tool adaptor **10**, constructed and operative in accordance with a non-limiting embodiment of the present invention.

Surgical tool adaptor **10** includes a distal interface member **12** and a handle **14**. Distal interface member **12** includes a connecting element **16** for connecting to a surgical tool **18** (FIG. **2**). (For example, distal interface member **12** may be a screwdriver connector for connecting to a screwdriver.) The connecting element **16** may include, without limitation, a locking knob with an internally threaded bore or a male or female connector for connection with the surgical tool **18**. Surgical tool adaptor **10** is formed with a central passageway or lumen **20** formed through distal interface member **12** and handle **14**.

The surgical tool **18** may include, without limitation, a screw, a screwdriver, a tap, a bore, an awl, a probe, or a jamshidi needle and the like. Surgical tool **18** is formed with a lumen **22**. Two or more surgical tools may be connected to each other, such as a screwdriver connected to a pedicle screw.

A K-wire **24** (FIG. **2**) passes through central passageway **20** of surgical tool adaptor **10** distally through distal interface member **12** into lumen **22** of surgical tool **18** and distally out the distal tip of surgical tool **18** (the distal end of K-wire **24** is seen in FIG. **2**). An entrance hole **23** (FIG. **1**A) is formed at the top of handle **14** for introducing the K-wire **24** into the handle **14**. A K-wire connector **26** is disposed in handle **14**. K-wire **24** passes through K-wire connector **26** and is locked in place by a locking element **28** (such as, but not limited to, a set screw).

In summary to this point, surgical tool adaptor **10** can be fixed on surgical tool **18** by locking distal interface member **12** onto surgical tool **18** with connecting element **16**. The K-wire **24** passes through the lumens of surgical tool adaptor **10** and surgical tool **18**. The K-wire **24** is locked in place with locking element **28**.

The present invention provides a K-wire adaptor control system for controlling the amount the sharp tip of K-wire **24** protrudes from the distal end of surgical tool **18**, as is now explained.

The K-wire adaptor control system includes first and second ratchet mechanisms **30** and **32**, respectively (FIG. **2**). The term "ratchet" encompasses not only mechanisms with a pawl and teeth, but also any kind of mechanism that permits motion (rotation or linear motion or a combination of such motions) in one direction only (e.g., only clockwise or only counterclockwise). Thus, the term ratchet as used herein not only encompasses a ratchet but also one-way bearings, for example. The K-wire adaptor control system is a type of clutch mechanism.

The first and second ratchet mechanisms **30** and **32** divide the use of the surgical tool **18** into two distinct and separately controlled actions. Rotation of handle **14** in a first direction (e.g., clockwise) turns surgical tool **18** in the first direction (e.g., so as to turn a screwdriver to threadingly advance a screw into bone). Rotation of handle **14** in a second direction, opposite to the first direction (e.g., counterclockwise) moves the tip of K-wire **24** proximally (backwards) while the surgical tool **18** is held stationary in place.

The first ratchet mechanism **30** is operatively connected between distal interface member **12** and handle **14**. The second ratchet mechanism **32** is operatively connected between a K-wire adjustment knob **34** and handle **14**. The first and second ratchet mechanisms **30** and **32** work in

opposite directions: when the first ratchet mechanism **30** allows rotation the second ratchet mechanism **32** blocks rotation and vice versa. The K-wire adjustment knob **34** and handle **14** may be threaded the same way, or alternatively, may be threaded in different directions (one right-handed threads and the other left-handed threads).

When rotating handle **14** in the first direction (e.g., clockwise, such as to advance a screw), the first ratchet mechanism **30** does not freely move and instead transfers the moment from handle **14**, thereby turning surgical tool **18** in the first direction (e.g., so as to turn a screwdriver to threadingly advance a screw into bone). The first ratchet mechanism **30** locks distal interface member **12** and handle **14** together, which means the K-wire advances together with the surgical tool **18**. The protrusion of the top of the K-wire remains constant. The second ratchet mechanism **32** turns freely in the first direction, meaning K-wire connector **26** is declutched with respect to adjustment knob **34**.

Optionally, a third ratchet (not shown) may be provided that allows axial movement between K-wire connector **26** and K-wire connector **12** when turning K-wire adjustment knob **34** and release the lock when rotating the handle **14** in the second direction so to allow the K-wire connector **26** to remain stationary while the handle **14** is rotated with the knob **34**.

When rotating handle **14** in the second direction (e.g., counterclockwise), first ratchet mechanism **30** declutches distal interface member **12** from K-wire connector **26**, which means the K-wire is now free to move with respect to surgical tool **18**, thus allowing adjustment of the K-wire tip protrusion.

In the second direction, the second ratchet mechanism **32** fixes handle **14** with respect to adjustment knob **34**. When rotating handle **14** in the second direction, adjustment knob **34** rotates together with the handle **14** and this causes K-wire connector **26** to move proximally with respect to distal interface member **12**, thus moving the K-wire tip proximally (backwards).

The second ratchet mechanism **32** allows rotation of adjustment knob **34** individually relative to handle **14** for the preliminary adjustment of the K-wire length relative to the distal tip of the tool **18**. The knob **34** allows only forward (distal) adjustment. As mentioned before, backing the K-wire tip relative to the tool tip is performed by rotating the handle **14** in the second direction (e.g., counterclockwise).

The surgical tool adaptor **10** is adjustable so that its proximal end (entrance hole **23** seen in FIG. **1**A) can be flush with the proximal end of the K-wire, so that the surgeon can hammer or otherwise apply force on the proximal end of the surgical tool adaptor **10** in order to advance the K-wire and screw or tool together.

In another embodiment of the invention, a force sensor **35**, such as but not limited to, a load cell, strain gauge or impedance sensor, is mounted on the K-wire **24** (FIG. **2**). The force sensor **35** can sense and alert changes in load applied on the tip of wire **24**. For example, when the wire **24** touches a cortical bone, bending of axial forces are sensed by force sensor **35**, which sends a signal to a processor (not shown) that alerts the surgeon that the screw is about to breach the pedicle or vertebral body. Alternatively, the system can detect and alert when the load is reduced, for example, if the tip has crossed the pedicle into the cancellous bone.

Reference is now made to FIGS. **3**A-**3**G, which illustrate a surgical tool adaptor **40**, constructed and operative in accordance with a non-limiting embodiment of the present invention.

Surgical tool adaptor **40** includes a handle **42**, which as seen in FIG. **3**G, may include winged protrusions **42**A for easy turning, a hub **42**B that fits through a bushing **42**C that affixes to a barrel **42**D. Handle **42** is rotatingly mounted on a distal interface member **44**, which similarly to the previous embodiment, includes a connecting element **46** for connecting to a surgical tool **18**, such as but not limited to, a screwdriver that can pass through a tower **48** for screwing a pedicle screw **50** (FIGS. **3**A-**3**C). Alternatively, as before, surgical tool **18** may include, without limitation, a screw, a tap, a bore, an awl, a probe, or a jamshidi needle and the like.

A K-wire **24** (FIGS. **3**A-**3**C) passes through a central passageway of surgical tool adaptor **40** distally through distal interface member **44** and connecting element **46**, and distally out the distal tip of surgical tool **18**. K-wire **24** passes through a K-wire adjustment screw **52** and may be locked in place by a locking element **54** (such as, but not limited to, a set screw in FIGS. **3**A and **3**C). K-wire adjustment screw **52** serves as a K-wire connector.

As seen in FIG. **3**E, the distal interface member **44** may be formed with an annular groove **54**, which is provided with a ball **56**. Handle **42** may be connected to distal interface member **44** by forcing the handle over the groove **54** so that the ball **56** fits into an annular recess (not shown) inside the handle **42**. In this manner, the handle **42** is constrained to rotate about distal interface member **44** (smooth rotation due to the ball **56**) and the handle **42** cannot be pulled out axially from distal interface member **44**.

As seen in FIG. **3**A, the K-wire adjustment screw **52** is inserted through a lumen **58** in the handle **42** until it threadingly mates with internal threads **60** formed in the handle **42**. As seen in FIG. **3**E, K-wire adjustment screw **52** has anti-turning structure **62**, such as flats formed at the top of the screw **52**. These flats sit in a corresponding square aperture (not shown) in handle **42** so that screw **52** can only turn together with handle **42** and cannot turn independently of handle **42**.

K-wire adjustment screw **52** preferably has the same screw pitch as the pedicle screw **50** to ensure synchronized motion with the screw **50**.

As seen in FIG. **3**G, handle **42** is connected to a ratchet assembly **64** (type of clutch mechanism), which may include a sleeve member **66** formed with a stop **68** and a guide groove **70**. Ratchet assembly **64** further includes a mode transition element **72** and a ratchet member **74**, formed with ratchet teeth **76** on a bottom surface thereof that can engage teeth **78** formed on an upwardly facing surface of distal interface member **44** (FIG. **3**F). The mode transition element **72** may be biased against sleeve member **66** and against ratchet member **74** by biasing devices **80**, such as coil springs. Handle **42** may have an internal pin (not shown) that engages a helical groove **82** formed on mode transition element **72**, so that turning handle **42** causes axial movement of mode transition element **72**. The mode transition element **72** and the ratchet member **74** are locked for rotation relative to sleeve member **66** with a pin that fits in groove **70**. This connection permits axial movement and prevents rotation.

In operation, the adjustment of K-wire **24** is achieved by rotating handle **42** relative to distal interface member **44**.

The surgical tool adaptor **40** has three working modes:

1. Adjustment of K-wire protrusion from the distal tip of the screw **50** (or whatever tool or item is connected to adaptor **40**)
2. Advancement or retraction of the screw **50** and K-wire **24** together as one unit

3. Advancement of the screw **50** while retracting the K-wire **24** to enable inserting the screw **50** while securing the position of the sharp K-wire tip

The selection of the operational mode depends upon the position of mode transition element **72**, which can be moved to three different operational positions by handle **42**. In a first position, the mode transition element **72** is completely disengaged from distal interface member **44** (that is, teeth **76** and **78** do not mesh). In the first position, K-wire **24** is free to move with respect to screw **50** (operational mode one, for adjusting the amount of K-wire protrusion from the distal tip of the screw **50**).

In the second position, turning handle **42** (e.g., clockwise) brings the handle **42** against stop **68** and locks K-wire **24** to move together with screw **50** (operational mode two).

The third position is intermediate the first and second positions. In the third position, the K-wire **24** can advance in clockwise rotation together with screw **50** by ratchet engagement of teeth **74** and **76**; however, counterclockwise rotation causes the K-wire **24** to move freely and independently of screw **50** (so that K-wire **24** can be moved back proximally without affecting the position of screw **50**—operational mode three).

Reference is now made to FIGS. **4**A-**4**D, which illustrate a surgical tool adaptor **90**, constructed and operative in accordance with a non-limiting embodiment of the present invention.

Surgical tool adaptor **90** may be constructed similar to surgical tool adaptor **40**, except that surgical tool adaptor **90** does not have a ratchet assembly, Instead, surgical tool adaptor **90** includes first and second handles **91** and **92**. The first handle **90** is arranged to rotate the K-wire adjustment screw, while the second handle **92** is arranged to rotate the pedicle screw. Accordingly, rotation of the first handle **91**, while the second handle **92** remains stationary, moves the K-wire but not the screw (operational mode one, for adjusting the amount of K-wire protrusion from the distal tip of the screw **50**). Rotation of the first handle **91** together with the second handle **92** moves the K-wire together with the screw (operational mode two). Thus, when the surgeon holds both handles he/she advances or retracts the screw with the K-wire into or out of the pedicle. When the surgeon rotates only the second handle **92**, he/she inserts the screw over the K-wire. The first handle **91** may be used to verify that the K-wire is not pushed by the screw further into the vertebral body. The tip of the k-wire is anchored in the bone and so rotation of the screw when guided over the k-wire does not apply moment that rotates the first handle **91**. The two handles form a type of clutch mechanism.

An additional scale insert **93** can be mounted in the adaptor **90** to provide an indication of relative movement.

In another option surgical tool adaptor **90** does have a ratchet assembly, which forms a ratchet connection between handles **91** and **92**. In this option, in a first rotational direction (e.g., clockwise), handles **91** and **92** rotate together, whereas in a second rotational direction (e.g., counterclockwise), only first handle **91** (the K-wire handle) can rotate (e.g., to retract the K-wire to its original position), while the second handle **92** does not rotate. The resolution of the ratchet may be, for example, one half turn.

What is claimed is:

1. An assembly comprising:

a surgical tool adaptor comprising a distal interface member and a handle, said distal interface member comprising a connecting element for connecting to a surgical tool, a central passageway being formed through said distal interface member and said handle;

a K-wire connector disposed in said central passageway for receiving therethrough a K-wire, said K-wire connector comprising a screw-thread capturing element for capturing the K-wire; and

a clutch mechanism operatively connected to said distal interface member and to said K-wire connector, wherein in a first orientation of said clutch mechanism, said distal interface member and said K-wire connector move together, and in a second orientation of said clutch mechanism, said distal interface member is declutched from said K-wire connector, such that in the first orientation movement of said handle moves said distal interface member and said K-wire connector together, and in the second orientation said distal interface member and said K-wire connector move independently of each other.

2. The assembly according to claim **1**, wherein in the second orientation, a movement of said handle moves said K-wire connector while said distal interface member remains stationary.

3. The assembly according to claim **1**, wherein in the second orientation, a movement of said handle moves said distal interface member while said K-wire connector remains stationary.

4. The assembly according to claim **1**, wherein in the second orientation, a movement of said handle moves said distal interface member in one direction and moves said K-wire connector in a different direction.

5. The assembly according to claim **1**, wherein said clutch mechanism is movably connected to said handle.

6. The assembly according to claim **1**, wherein said clutch mechanism comprises a first ratchet mechanism operatively connected between said distal interface member and said handle, wherein in a first direction of movement of said handle, said first ratchet mechanism causes said distal interface member and said handle to move together, and in a second direction of movement of said handle, said first ratchet mechanism declutches said distal interface member from said K-wire connector, such that in the first direction, movement of said handle moves said distal interface member and said K-wire connector together, and in the second direction, movement of said handle moves said distal interface member without moving said K-wire connector.

7. The assembly according to claim **6**, further comprising an adjustment knob operative to move said K-wire connector independently of said first ratchet mechanism.

8. The assembly according to claim **7**, further comprising a second ratchet mechanism operatively connected between said adjustment knob and said handle, wherein in the first direction of movement of said handle, said second ratchet mechanism declutches said K-wire connector with respect to said adjustment knob, and in the second direction of movement of said handle, said second ratchet mechanism causes said adjustment knob and said K-wire connector to move together, such that in the second direction, movement of said handle moves said adjustment knob and said K-wire connector together.

9. The assembly according to claim **1**, wherein said clutch mechanism comprises a ratchet assembly that comprises a mode transition element and a ratchet member formed with ratchet teeth arranged to engage teeth formed on said distal interface member, and wherein said handle engages said mode transition element; such that turning said handle causes axial movement of said mode transition element.

10. The assembly according to claim **1**, wherein said clutch mechanism comprises an auxiliary handle connected to said distal interface member, and wherein said handle of

said surgical tool adaptor is connected to said K-wire connector and said handle of said surgical tool adaptor and said auxiliary handle are coaxial.

11. The assembly according to claim **1**, further comprising a K-wire disposed through said central passageway and coupled to said K-wire connector.

12. The assembly according to claim **1**, further comprising a surgical tool connected to said connecting element.

* * * * *